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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MING-CHI LIAW,
TIENG-SHENG CHAO, and
TAN-FU LEI

Appeal 2009-009254
Application 10/620,560
Technology Center 1700

Decided: March 31, 2010

Before MICHAEL P. COLAIANNI, BEVERLY A. FRANKLIN, and
LINDA M. GAUDETTE, *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants appeal under 35 U.S.C. § 134 the final rejection of claims 13-21, and 24-27.¹ We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

¹ Appellants state that claim 27 is on appeal (App. Br. 2) and the Examiner indicates in the “Office Action Summary” sheet of the Final Office Action that claim 27 is rejected (Final Off. Act. dated Nov. 15, 2006). However,

We AFFIRM.

Appellants describe a process for selectively removing side wall residue after dry etching (Spec. 1).

Claims 13 and 21 are illustrative:

13. A process for selectively removing silicon dioxide and photoresist sidewall residue after dry etching of a semiconductor wafer comprising treating the wafer after dry etching with a solution consisting essentially of;

- (a) sulfuric acid,
- (b) hydrogen fluoride, ammonium fluoride or an alkali metal fluoride, and
- (c) hydrogen peroxide,

wherein said solution contacts said sidewalls residue effectively to remove it from said dry etched wafer,

and wherein the ratio (a):(b) is in the range of from 10:1 to 700:1 by weight.

21. A process for selectively removing silicon dioxide and photoresist after dry etching of a semiconductor wafer comprising treating the wafer after dry etching with a solution consisting essentially of sulfuric acid, hydrofluoric acid and hydrogen peroxide wherein the ratio of sulfuric acid plus hydrofluoric acid to hydrogen peroxide is 3:1 by volume.

The Examiner relies on the following prior art reference as evidence of unpatentability:

Ohnishi

EP 0 618,612 A2

Oct. 5, 1994

claim 27 is not included in any statement of the rejections on appeal and the subject matter of claim 27 is not specifically addressed in the body of any rejection (Ans. and Final Off. Act. *generally*). Accordingly, we view claim 27 as pending but not rejected, and thus not subject to appeal.

The appealed rejections are as follows:

1. Claims 13, 15, 16, 18-20, 24, and 25 are rejected under 35 U.S.C. § 102(b) as being anticipated by Ohnishi, or alternatively under 35 U.S.C. § 103(a) as obvious over Ohnishi.
2. Claims 14, 17, 21, and 26 are rejected under 35 U.S.C. § 103(a) as obvious over Ohnishi.

Regarding rejection (1), Appellants argue claim 13 only. With regard to rejection (2), Appellants argue claim 21 only.

Rejection (1)

ISSUE

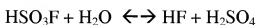
Have Appellants identified error in the Examiner's determination that based upon the similar result of removing sidewall residue after dry etching using a similar composition the claimed ratio of sulfuric acid to hydrogen fluoride of claim 1 is taught or would have been suggested by Ohnishi? We decide this issue in the negative.

PRINCIPLES OF LAW

Where the claimed and prior art products are identical or substantially identical, the PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of the claimed product. *In re Best*, 562 F.2d 1252, 1255 (CCPA 1977). Whether the rejection is based on 'inherency' under 35 U.S.C. § 102, on 'prima facie obviousness' under 35 U.S.C. § 103, jointly or alternatively, the burden of proof is the same, and its fairness is evidenced by the PTO's inability to manufacture products or to obtain and compare prior art products. *Id.*

FACTUAL FINDINGS (FF)

1. The Examiner finds that Ohnishi teaches adding fluorosulfuric acid to sulfuric acid and hydrogen peroxide, which functions as a precursor to generate hydrogen fluoride via the following reversible reaction dynamic:



- (Ans. 5, 12). Appellants do not contest this finding.
2. The Examiner finds that because Ohnishi's cleaning process, like Appellants' process, removes silicon sidewall residue after a dry etching process and the reaction dynamic produces an amount of HF, there is a reasonable basis for finding that Ohnishi's process and cleaning composition used therein is the same as recited in Appellants' claims (Ans. 5 and 12).
 3. Ohnishi's Figure 3 depicts the variation in etch rates versus time for fluorosulfuric acid (HSO_3F), sulfuric acid and hydrogen peroxide solution compared to the etch rates for a hydrogen fluoride (HF), sulfuric acid, hydrogen peroxide solution over time (Fig. 3; col. 7, ll. 38-53). The fluorosulfuric acid solution data consists of two data points (Fig. 3), with a line extrapolated between these data points. The Examiner finds the data in Figure 3 as being inconclusive because the data at greater times is missing from the fluorosulfuric acid solution data and the existing data may be interpreted as demonstrating the similarities between the hydrogen fluoride and fluorosulfuric acid solutions (Ans. 10). Specifically, the Examiner

- finds that at the 1 hour time interval the data for the hydrogen fluoride and fluorosulfuric acid solutions is shown to be about the same (Fig. 3; Ans. 10).
4. Regarding the Figure 3 data, Ohnishi states that a correct comparison of the etch rate at time zero cannot be made because different concentrations of the hydrogen fluoride and fluorosulfuric acid are used (col. 7, ll. 45-49).
 5. Though conceding that Ohnishi's "1% hydrofluoric acid" disclosure may have different meanings as argued by Appellants (App. Br. 5, Ans. 13), the Examiner finds that Ohnishi's comparative example in column 7 discloses mixing 1% of a standard 49% hydrofluoric acid solution so as to anticipate Appellants' claimed invention (Ans. 14).
 6. Ohnishi discloses that the reversible reaction mechanism is used to adjust the water, hydrogen fluoride or fluoride ion concentrations in the solution (col. 7, ll. 24-37).
 7. The record states the Examiner construed the "consisting essentially of" transitional claim language of claim 13 as not excluding the fluorosulfuric acid because the reaction dynamic of FF 1 indicates that Appellants' composition contains the same fluorosulfonic component (Ans. 6). Appellants do not contest this claim construction (App. Br. and Reply Br. *generally*).

ANALYSIS

The Examiner's stated case is based, in part, on a similar cleaning composition having a reversible reaction mechanism of the composition that produces hydrogen fluoride, and a similar product resulting from the

cleaning process (i.e., a dry etched product with silicon dioxide sidewall residue removed). Based on these findings, the Examiner has set forth a reasonable basis for determining that the claimed process having the particular ratio of sulfuric acid to hydrogen fluoride is anticipated or would have been obvious over Ohnishi. *Best*, 562 F.2d at 1255. Accordingly, the burden shifted to Appellants to show that Ohnishi's process does not possess the claimed cleaning composition having the sulfuric acid to hydrogen fluoride ratio. *Id.*

In that regard, Appellants argue that Ohnishi's Figure 3 demonstrates that a fluorosulfuric acid solution is not the same as the claimed hydrogen fluoride solution because the lines in Figure 3 are not parallel, which should be case if an equilibrium reaction is achieved (App. Br. 4). Appellants contend that Ohnishi's teachings are so ambiguous that an artisan would not be able to determine a reference solution with which to compare (App. Br. 5). Appellants argue that Ohnishi's comparative example is unclear regarding how much of the hydrogen fluoride is added to the solution, such that it is impossible to determine the ratio of sulfuric acid to hydrogen fluoride (App. Br. 5).

Contrary to the argument, we note that the data depicted in Figure 3 is inconclusive at best. The data points at time zero are called into question by Ohnishi's express statement that a correct comparison of the etching rates between hydrofluoric acid and fluorosulfuric acid at time zero is not possible. Moreover, the fluorosulfuric acid and the hydrofluoric acid data point at time 1 hour overlap, which further supports the Examiner's case that the solutions appears to be the same. No other actual data is provided for the

fluorosulfuric acid solution, so we cannot tell if the extrapolated line for that data is correct or if the data may mimic the data for the hydrofluoric acid.

Appellants' arguments regarding the reference solution appears to be directed to Ohnishi's disclosure regarding the comparative example that uses 1% hydrofluoric acid. However, the meaning of "1% hydrofluoric acid" is not dispositive because Appellants have not presented persuasive evidence that the cleaning composition used in Ohnishi's process patentably differs from that claimed by Appellants. As noted above the Figure 3 evidence argued by Appellants is inconclusive and thus is insufficient to satisfy Appellants' burden to show that Ohnishi's composition differs such that the claimed sulfuric acid to hydrogen fluoride ratio is missing from Ohnishi's cleaning composition and process.

With regard to the obviousness aspect of the rejection, Appellants further argue that Ohnishi teaches away from using HF and Ohnishi fails to teach a solution "consisting essentially of" the claimed components (App. Br. 6).

However, Appellants do not contest the Examiner's claim construction that "consisting essentially of" includes fluorosulfuric acid because Ohnishi's reaction mechanism indicates that the same fluorosulfonic acid component is present in Appellants' composition used in the process. In other words, Ohnishi teaches forming HF as part of the reversible reaction mechanism, which it reasonably appears that Appellants' composition undergoes too. Accordingly, Ohnishi does not teach away from using or producing HF as part of the composition. Indeed, to determine otherwise would destroy Ohnishi's reaction mechanism.

Accordingly, Appellants have not identified error in the Examiner's determination that based upon the similar result of removing sidewall residue after dry etching using a similar composition the claimed ratio of sulfuric acid to hydrogen fluoride of claim 1 is taught or would have been suggested by Ohnishi.

We affirm the Examiner's rejection of claims 13, 15, 16, 18-20, 24, and 25 under §102(b) or alternatively under § 103 as being unpatentable over Ohnishi.

REJECTION (2): § 103 OVER OHNISHI ALONE

ISSUE

Have Appellants shown that the Examiner erred in determining that the claimed ratio of the solution components recited in claim 21 is a result-effective variable that would have been optimized? We decide this issue in the negative.

FACTUAL FINDINGS

8. Appellants do not contest the Examiner's finding that Ohnishi teaches that the composition ratio is a result-effective variable (Ans. 8; App. Br. 7-8).

ANALYSIS

Appellants contend that Ohnishi does not teach a solution having the 3:1 ratio recited in claim 21 (App. Br. 7). Appellants contend that the ratio is important to the invention because it allows removal of the sidewall residue without damaging the Poly-Si and bottom SiO₂ layer (App. Br. 7).

These arguments are not persuasive because they fail to address the Examiner's stated case that Ohnishi recognizes the ratio of the components as a result-effective variable that would have been optimized to include the claimed 3:1 ratio. Though Appellants allege that the claimed ratio is critical to avoid damaging the Poly-Si and SiO₂ layers, there is no disclosure in Ohnishi that the cleaning solution used in the process harms the Poly-Si or silicon substrate as depicted in Figures 7a and 7b.

For the above reasons, we affirm the Examiner's § 103 rejection of claims 14, 17, 21, and 26 over Ohnishi.

DECISION

The Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(2009).

ORDER

AFFIRMED

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